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| EXAMINER | |
|---|---|
| HORNING, JOEL G | |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/594,284 | WITZMANN ET AL. | |
| | Examiner | Art Unit | |
| | JOEL G. HORNING | 1712 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *21 October 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *2-6,8,17-19 and 21-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-6,8,17-19 and 21-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 21st, 2010 has been entered.

### *Status of Claims*

2. In the response of October 21st, 2010, applicant has: amended claims 2-6, 8, 17 and 22; cancelled claim 7; and added claim 23. Claims 2-6, 8, 17-19 and 21-23 are currently pending.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. **Claims 22 and 23** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Wang et al (Applied Surface Science **221** (2004) 293-301).

Recasens et al is directed towards the formation of refractory bricks (zirconium containing bricks), specifically ones to be used in glass furnaces (abstract) because of its high resistance to corrosion by molten glass (when the bricks are placed in contact with a glass melt during processing of the glass melt in the furnace). Its composition comprises alumina, silica, zirconia and chromium oxide and produces a vitreous phase (col 1, lines 29-40), Recasens et al further teaches that the inclusion of zirconia into the refractory adds plasticity to the composition which reduces cracking in the resulting refractory bricks (col 3, lines 19-30).

Wang et al is directed towards a process for treating the surface of refractory bricks which, like Recasens et al, also comprises alumina, silica and zirconia (abstract). These bricks are, like Recasens, to be used as linings for furnaces which will be in contact with molten glassy material (slag). Wang et al, also like Recasens, recognizes that ingress of the glassy material into the refractory bricks causes corrosion and erosion of the refractory, which is undesirable. In order to solve this problem, Wang et al teaches eliminating cracks and porosity from the surface of the refractory, sealing it (Introduction). This is performed by exposing the

refractory surface to $CO_2$ laser radiation, which seals the surface (closed) porosity and can result in a crack-free, dense laser treated layer on the refractory (abstract). The resulting layer structure is taught to have no apparent cracks or flaws, it is closed (section 3.2).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to treat the refractory composition of Recasens et al by the process of Bradley et al: closing the porosity in a surface layer of the refractory in order to improve its corrosion resistance to molten glass, which the refractory would be in contact with when used in the intended glass furnace of Recasens et al.

Regarding the limitation that the laser treatment layer of the refractory be vitreous, as mentioned above, Recasens et al teaches that their refractory composition includes a vitreous phase, so there should be vitreous material in the treated layer, making it vitreous.

Additionally, in applicant's specification, page 2, lines 20-22, applicant teaches that laser treatment to minimize porosity causes siliceous components of the refractory to partially or completely vitrify. Wang et al teaches performing a similar laser treatment process to similar materials (in particular silica containing refractory materials, commonly known as glass-ceramics) in order to produce the same effect of creating a surface region of reduced porosity to increase the durability of the refractory to contact with molten glassy material.

When a reference discloses the limitations of a claim except for a property, and the Examiner cannot determine if the reference inherently possesses that

property (in this case, that at least some of the material in the layer is vitreous), the burden is shifted to Applicant(s). In re Fitzgerald, USPQ 594 and MPEP §2112

Since the refractory material is what is modified by the laser to produce the closed layer, the closed layer will contain materials from the refractory material. Tempering is not required by the process.

Furthermore, since the intent of Recasens et al is to use the refractory in glass furnaces where they are in contact with a glass melt, it is obvious to process a glass melt with it in contact with the refractory of Recasens et al in view of Wang et al **(claim 22)**.

Regarding **claim 23**, the additional step of spraying the surface with a powder or solution is not required.

4. **Claims (2-6)/17, 17-19 and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Wang et al (Applied Surface Science **221** (2004) 293-301) as applied to claim 22, further in view of Torok et al (US 3360353) as evidenced by Triantafyllidis et al (Applied Surface Science 186(2002) 140-144).

Recasens et al in view of Wang et al does not teach using their treated refractory bricks suitable for use in a glass furnace specifically in a Danner blowpipe section of a glass furnace.

However, Torok teaches a furnace and method for producing glass wherein molten glass is in contact with a refractory coated mandrel during the process (abstract) and the mandrel can be a Danner blowpipe (col 1, lines 45-60). Torok

teaches that the refractory material on the mandrel is formed of several uniform diameter segments, which can be considered bricks (col 3, lines 68-75). Torok further teaches that the refractory bricks of the Danner blowpipe erode as the molten glass is in contact, forming glass tubing. This causes defects in the produced glass tubing which necessitates replacing the refractory material in a time consuming process (col 1, line 62 through col 2, line 14).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to use the laser treated refractory bricks of Recasens et al in view of Wang et al in the Danner blowpipe and glassmaking process of Torok since they were refractory bricks suitable for such furnaces and it would reduce the erosion of the refractory bricks, allowing the production of longer sections of high quality pipe and increase the period between time consuming replacements of the refractory bricks of the blowpipe

Tempering is not required by the claim **(claim 17)**.

5. Regarding **claim 2/17**, Wang et al teaches that alpha alumina and metastable zirconia melt during their process and both melting temperatures are above 2000°C, within the claimed range, so the refractory is heated to temperatures within this range (section 4.2).

6. Regarding **claim (4-5)/17,** Wang teaches using a beam diameter of 4mm and a scanning velocity of 4-12mm/s (which overlaps with applicant's claimed values) (section 2), so that the exposure time is ~0.33-1 second.

7. Regarding **claims (3-5)/17**, Wang et al teaches that the power, beam diameter and the beam scanning rate are operating parameters (from these parameters, the power density and the exposure time can be determined, so they are equally known as operating parameters), which are all result effective variables for controlling the smoothness and surface cracking in the resulting laser treated surface (section 2 and section 3.1).

Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to choose the instantly claimed ranges of "a power density of 2 to 4W/mm$^2$" **(claim 3/17)**, "an effective exposure time of 0.1 to 5 s" **(claim 4/17)**, "a scan rate of 1-10 mm/s" and a laser beam "diameter of 2-5 mm" **(claim 5/17)** through process optimization, since it has been held that when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980).

**8.** Regarding **claim 6/17**, Triantafyllidis et al teaches that $CO_2$ lasers have a wavelength of 10.6 microns (page 141, section 2), which is within applicant's claimed range.

9. Regarding **claim 18,** from figure 3b of Wang et al, the surface layer is shown to be more than 100 microns but not more than 1000 microns, which is within applicant's claimed range.

**10.** Regarding **claim 19**, since the refractory material is what is modified by the laser to produce the closed layer, the closed layer will contain materials from the refractory, including aluminum and zirconium.

**11.** Regarding **claim 21**, since the laser treatment is performed on the refractory bricks that are later placed into the Danner blowpipe which is then used in contact with a glass melt, the laser treatment to produce the closed vitreous layer is clearly performed before contact with the glass melt.

12. **Claims 8 and (2-6)/1** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Wang et al (Applied Surface Science **221** (2004) 293-301), further in view of Torok et al (US 3360353) as applied to claim 17 above, further in view of Petitbon (US 4814575). Claim 8 further requires that the surface be sprayed with a powder or a solution before or during the laser treatment or that the ceramic body be infiltrated with a solution that includes zirconium or aluminum containing compounds.

Recasens et al in view of Wang et al in view of Torok et al is directed towards methods of laser treating ceramic bodies so that the amount of porosity on the surface of the refractory is decreased, which improves the corrosion and spalling resistance of the refractory, but it does not teach adding a powder to the surface during laser exposure.

However, Petitbon is also directed towards methods of laser treating ceramic bodies so that their surface porosity is reduced. It teaches that by spraying a ceramic powder onto the substrate during the laser treatment, so that the powder

and substrate surface melt, the molten powder particles will fill available surface porosity, thus reducing the presence of porosity or microcracks on the substrate surface, improving the microstructure and improving the properties (thermal expansion coefficient, residual stress, etc) of the surface (col 2, line 40 through col 3, line 13).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention performing the process of Recasens et al in view of Wang et al in view of Torok et al to spray a powder at the substrate so that they melt together during laser treatment in order to avoid surface porosity or microcracks that may be present in the final surface, thus increasing the corrosion and spalling resistance as well as other properties of the substrate **(claim 8)**.

13. **Claims (2-6)/1** are rejected for the same reasons they were previously, but now in view of Petitbon.

***Response to Arguments***

14. Applicant's arguments with respect to all pending claims have been considered but are not convincing in view of the new ground(s) of rejection necessitated by amendment.

15. Applicant argues that Torok teaches a different way to mitigate erosion of the mandrel than applicant or Wang uses, so it leads away from using applicant's claimed (or Wang's taught) method. However, as presented in the rejection, the prior art knows several ways to increasingly mitigate this erosion problem and, "[t]he prior art's mere disclosure of more than one alternative does not constitute a

teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed…." In re Fulton, 391 F.3d 1195, 1201, 73 USPQ2d 1141, 1146 (Fed. Cir. 2004)."

Additionally, Torok does not teach that erosion no longer happens in its process, only that it is delayed, so there is still a motivation to further reduce the erosion in Torok by additionally using other methods in the prior art. That is, a practitioner in the art would be motivated to do both processes to improve the erosion resistance of the refractory bricks.

16. Applicant then argues that it is not routine optimization to determine appropriate temperatures, power densities, exposure times, scan rates and beam diameters. Though determining the optimal processing parameters for any of process can require a significant number of experiments, however, as stated by applicant, it is the routine practice in this laser treatment art to perform such experimentation to determine the optimal values for different processing parameters.

17. Petitbon teaches that leaving a “few microcracks” in the treated surface will improve the toughness of the layer. From this applicant argues that it teaches away from having a closed surface. Petitbon also teaches that its process results in a “sealed surface” with porosity that is nil (col 5, lines 14-20). However, directly responding to applicant’s argument, this teaching is not a teaching that it is impossible to seal the surface, only that an improved toughness will result from leaving a few defects. This actually indicates that the surface can be completely sealed, so it is not a teaching that would lead a practitioner to believe that it is impossible to do what Wang

teaches is desirable. In fact, in view of the Wang reference, it is clear that a practitioner, when making refractory in contact with glass that will erode it would then be motivated to completely close the surface and would use the Petitbon inclusion of a powder material, as it is taught to remove surface defects, in order to aid in this closure of the surface

***Conclusion***

18. No current claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL G. HORNING whose telephone number is (571) 270-5357. The examiner can normally be reached on M-F 9-5pm with alternating Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael B. Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. G. H./
Examiner, Art Unit 1712

/Michael Cleveland/
Supervisory Patent Examiner, Art Unit 1712